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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : D01G 15/28 — A1

(11) International Publication Number: **WO 00/05441**

(43) International Publication Date: 3 February 2000 (03.02.00)

(21) International Application Number: PCT/GB99/02213

(22) International Filing Date: 23 July 1999 (23.07.99)

(30) Priority Data:
9815951.0 23 July 1998 (23.07.98) GB

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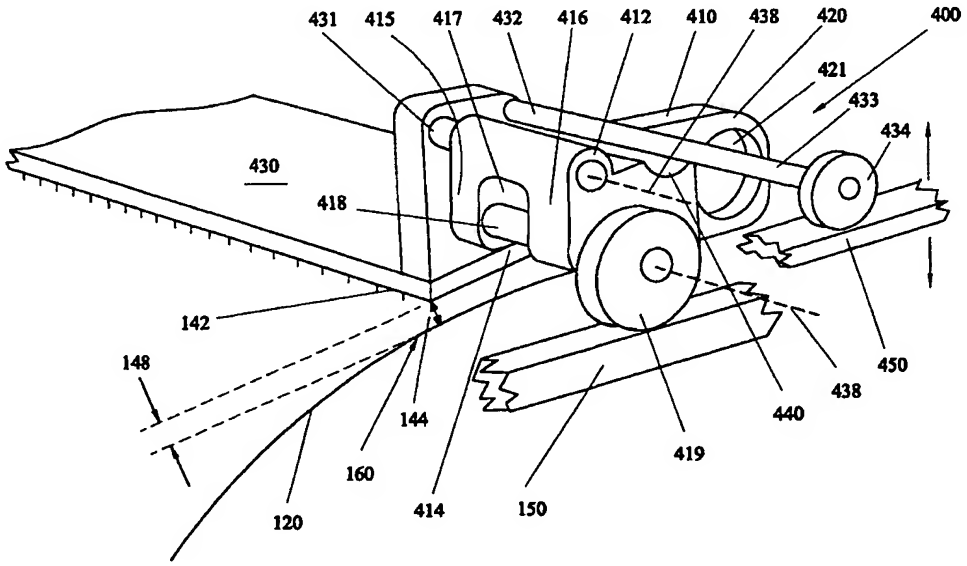
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: ADJUSTABLE CARDING FLAT



(57) Abstract

There is provided an adjustable carding flat (140) assembly for use with a carding engine (100). The carding engine includes a carding cylinder (120), a first guide means and a second guide means. The assembly includes a pair of carriages (152), each having a pivot formation (412) and a carding flat having pivot members. The pivot members each engage a respective pivot formation of the pair of carriages. The carding flat also has an adjustment member. The pair of carriages are guided by the first guide means (150) and the adjustment member engages the second guide means (450) to control the inclination of the carding flat with regard to the carding cylinder.

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Adjustable Carding Flat

The present invention relates to an adjustable carding flat assembly for use in a carding engine and in particular, but not exclusively, to a carding flat assembly which allows the inclination of each of a number of movable flats to be adjusted together.

In a carding engine, the inclination of the carding flats with respect to an adjacent cylindrical working surface area of the carding cylinder is fixed. The separation of the heel of the flats from the working surface of the carding cylinder is fixed and contributes to the quality of the carded material. The inclination of the flats also has an effect on the quality of the carded material. Currently, the inclination of the flats is a set property. Hence it is not possible to alter the inclination of the flats during carding so as to fine tune the inclination to maximise the carding quality or to respond to variations in the material being carded. The inclination of the flats is determined by the geometry of the flats and supporting structure and it is necessary to re-machine the flats in order to alter their inclination. Further, if the inclination needs to be changed, it is currently necessary to alter all of the cards individually, which is time consuming and difficult, as correctly setting up a carding engine is a highly skilled job.

According to a first aspect of the invention there is provided a carding engine including a carding cylinder having a working surface area and at least one movable carding flat supported in a carding flat assembly adjacent the working surface area, in which the inclination of the carding flat relative to the carding cylinder is controllable to change the carding quality of the carding

engine. Preferably the carding flat is tiltable. More preferably, the carding flat is pivotable.

According to a second aspect of the invention there is provided an adjustable carding flat assembly for use with a carding engine including a carding cylinder, a first guide means for guiding the movement of the flat assembly relative to the cylindrical working surface of the carding cylinder and a second guide means, the assembly including a movable flat, a support means and an adjustment member, in which the support means runs on the first guide means and the adjustment means co-operates with the second guide means to control the inclination of the carding flat with respect to the carding cylinder. The carding flat can be tiltable. The carding flat can be pivotable.

The support means can include a pair of carriages each having a pivot formation and the movable flat can have pivot members each engaging a respective pivot formation of the pair of carriages, in which the pair of carriages are arranged to be guided by the first guide means.

The assembly can comprises a pair of carriage members each having a pivot formation. The carding flat has pivot members which engage respective pivot formations so that the carding flat is suspended between the carriage members and can pivot about the co-operating pivot formations and members to allow the inclination of the carding flat to be varied. The carriages run on a guideway and an adjustment member extends from the flat and engages a further guideway. The position of the second guideway with respect to the first guideway determines the inclination of the carding flat. In this way the inclination of the carding flat can be adjusted relative to a working surface area of the

carding cylinder by altering the position of the second guide means.

As the inclination of the carding flat is not set but is determined by the position of the second guide means, the inclination of the carding flat with respect to the carding cylinder can be controlled by altering the position of the second guideway. Hence the carding flat inclination and hence carding quality can be altered and controlled during the carding operation. Also the inclination of the carding flats can be altered without having to dismantle the carding flat from its support carriage.

Preferably the pivot members are positioned on the carding flat to be co-linear with the heel of the carding flat such that the separation of the heel of the carding flat from a working surface of the carding cylinder remains substantially constant when the inclination of the carding flat is altered. In this way the inclination of the carding flat can be altered without altering the separation of the carding flat heel from the working surface of the carding cylinder. The carding quality depends, *inter alia*, upon the separation of the carding cylinder and flat and so it is preferable to maintain this separation while still being able to adjust the inclination to fine tune the carding quality.

According to a third aspect of the invention there is provided a carding engine including:

a carding cylinder;

a first guide means having first and second parts disposed at opposite ends of the carding cylinder;

a second guide means; and

a movable flat assembly according to the second aspect of the invention.

A carding engine has a carding cylinder and a set of movable flats co-operable therewith. Each carding flat travels along a working surface area of the cylinder at which the carding of the material takes place. The carding flat is pivotally suspended between support means which run on guide means disposed at opposite ends of the carding cylinder so that the carding flat can be moved relative to the working surface area of the carding cylinder. By providing an adjustment member on the carding flat which engages a second guide means the angle of inclination of the carding flat can be controlled and adjusted without having to disassemble the carding flat and its support.

The second guide means may include a position adjustment means which acts to alter the inclination of the carding flat. The position adjustment means alters the position of the second guide means relative to a fixed point on the carding engine. As the adjustment means engages the second guide means, altering the relative position of the second guide means changes the angle of inclination of the carding flat by causing it to pivot between its pair of carriages.

Preferably the position adjustment means changes the position of the second guide means radially. The position adjustment means may cause the second guide means to shift inward or outward along a radial direction so as to alter the position of the second guide means with respect to a fixed point of the carding engine. The second guide means may be in the form of a flexible bend.

Preferably the carding engine has a plurality of adjustable carding flat assemblies connected together to form a flexible chain of assemblies. Each assembly may provide a pair of carriages which act as the link members of a pair of

parallel chains which support the carding flats between them. The flexible chain of assemblies then provides a continuous loop of carding flats which can be presented in turn to the working surface area of the carding cylinder.

The first and second carriages of a first pair may each be connected to the first and second carriages respectively of the next assembly in the flexible chain of assemblies by having an axle passing through a rear part of the first and second carriages of the first pair and a front part of the first and second carriages of the next assembly. In this way each carriage acts as a link in a flexible chain of carriages with a pivot provided by the axle joining the link carriages.

Preferably, the front part of each carriage has two formations defining a gap between them and the rear part of each carriage has a single formation which engages the gap of the next carriage in the chain. In this way the carriages may intermesh so as to provide a robust supporting chain transporting the carding flats.

Preferably, a longitudinal axis of the pivot formation of each carriage is parallel to and positioned substantially vertically above the longitudinal axis of the axle connecting each carriage to the next carriage. By ensuring that the axis of the carding flat/carriage pivot and the axis of the carriage to carriage axle are parallel and substantially vertically aligned, the separation of the heel of the carding flat from the working surface of the carding cylinder can be kept substantially constant when the carding flat is pivoted.

Each axle of the carriages may have a roller on an end and the rollers of the carriages may run on the first guide

means. The carriages may run on the first guide means by way of rollers, wheels or any other suitable bearing. Each carriage may have a slider attached to it and a part of the slider may run on or in the first guide means.

Preferably, the adjustment means includes a first extended member attached to the carding flat and having a first roller on a distal end which runs on the second guide means. The second guide means may have a first and a second part disposed at opposite ends of the carding cylinder, the first roller running on the first part of the second guide means, and the adjustment means including a second extended member attached to the carding flat and extending in a direction opposite to the direction of the first extended member and having a roller on a distal end which runs on the second part of the second guide means. In this way the adjustment means comprises a pair of extended arms with roller, wheels or any other suitable bearing thereon, which may engage parts of the second guide means disposed at opposite ends of the carding cylinder so as to robustly support the carding flat at an inclination controlled by the position of the second guide means relative to a fixed point of the carding engine.

The adjustment means may include a slider which, in use, engages in or on the second guide means. The adjustment means may include a pair of sliders extending in opposite directions and each engaging a respective part of the second guide means.

Preferably, the second guide means includes a flexible bend. The position of parts of the flexible bend may be adjusted independently. The position of the whole of the flexible bend may be adjusted. The flexible bend may comprises a number of sections. The flexible bend may be a continuous

member. The position of the number of sections may be adjusted independently. The flexible bends which make up the second guide means may have their positions adjusted as a whole, or the position of parts of the flexible bends may be adjusted independently. The position of the second guide means may vary with respect to the carding cylinder working surface area so as to alter the inclination of the carding flats as they traverse along the working surface are of the cylinder.

According to a fourth aspect of the invention, there is provided a method of operating a carding engine including a carding cylinder and a carding flat assembly having a pivotable flat adjacent a working area of the carding cylinder, in which the method includes altering the inclination of the carding flat relative to the working area so as to change the quality of carding.

Previously, the carding quality of a carding engine, i.e. the effect that the carding cylinder and carding flats have on the material being carded, has been varied by methods including providing a number of carding flats which are stationary relative to the position of the carding cylinder and a number of carding flats which move relative to the position of the carding cylinder. This method is particularly used when carding man made materials. The ratio of stationary to moving flats has also been found to have an effect on the carding quality. Another previous method of changing the carding quality has been to provide carding flats with an increased length, when viewed from the side of a carding cylinder, such that the leading end of the flat, the toe, is significantly further from the surface of the carding cylinder, where the carded material enters the working region of the carding engine, than it would be with a conventional length flat.

Both these previous methods, a mix of stationary and moving flats, and using longer flats to increase the flat toe to cylinder surface separation, have been found to provide changes in carding quality, which can be appropriate for different carding materials. It has been found that varying the angle of inclination of a carding flat relative to an adjacent carding cylinder according to the present invention, also provides changes in carding quality comparable to the previous methods but in a more flexible and controllable manner. Hence a method of carding in which the carding flat inclination is variable and controllable, without having to rebuild, re-engineer, re-design or otherwise alter a carding engine so as to change its carding quality, provides a carding quality which can be changed depending on the material to be carded or the desired carding results.

The method can include the step of changing the angle subtended by the carding flat and the working area surface of the carding cylinder.

According to a fifth aspect of the invention, there is provided a method of operating a carding engine including a carding cylinder, a guide means and a carding flat assembly having a movable flat, in which the method includes altering the position of the guide means relative to a fixed point of the carding engine so as to alter the inclination of the movable flat with respect to a working surface area of the carding cylinder so as to control the quality of carding.

By altering the position of the guide means relative to the carding engine, the inclination of the movable flat of the carding flat assembly can be altered and so the carding quality of the carding engine can be controlled. The inclination may be constant through out the working surface

area or may be caused to vary throughout the working surface area. The position of the guide means may be controlled in real time via a feedback control loop so as to maintain the carding quality at a fixed standard or the position may be adjusted intermittently in consideration of the carding requirements of different materials.

The present invention will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

Figure 1 shows an illustrative schematic diagram of a carding engine, to which the invention may be applied;
Figure 2 shows a schematic side view of an enlarged detail of the carding engine of Figure 1;
Figure 3 shows a schematic end view of the enlarged detail of the carding engine as shown in Figure 2;
Figure 4 shows a perspective view of part of the adjustable carding flat assembly of the current invention in use with a carding engine;
Figures 5(a) (b) (c) & (d) show side, plan, and end views respectively of a carriage component of the adjustable carding flat assembly of the current invention;
Figure 6 shows a schematic plan view of a flexible chain of assemblies in use with a carding engine;
Figure 7 shows an end view of a part of the assembly in use with a carding engine;
Figure 8 shows a schematic side view of adjustable carding flat assemblies of the invention in use with a carding engine;
Figure 9 shows a schematic perspective view of part of an alternative assembly of the invention; and

Figures 10 and 11 show schematic side and plan views respectively of parts of an alternative adjustable carding flat assembly according to the invention.

Identical items in the different Figures share common reference numerals.

With reference to figure 1 there is shown a schematic diagram of a typical carding engine, designated generally by reference numeral 100. The carding engine includes a taker-in 110 in the form of a rotating cylinder, a rotating carding cylinder 120 and a doffer 130. Positioned above the carding cylinder is a continuous chain of carding flats 140 which form a closed loop 145. The closed loop chain of carding flats is guided by running on a pair of bends (not shown) at respective ends of the carding cylinder and along a working surface area of the carding cylinder 160. Material to be carded is fed from the taker-in to the carding cylinder and is carded by the action of metal teeth on the carding flats and metal teeth on the surface of the carding cylinder 120. The peripheral speed of the carding cylinder is substantially greater than the linear speed of the carding flats and carding takes place in a working surface area of the carding cylinder 160. Carded material is then removed from the carding cylinder by the doffer 130. The carding flats 140 travel around the closed loop and trash may be removed from the carding flats after they have been moved out of the working region of the carding cylinder. The direction of rotation of the carding flats may be co or counter to that of the carding cylinder.

With reference to figure 2 there is shown an enlarged portion of the carding engine around the working surface area 160 of the carding cylinder 120. A carding flat 140 has a heel part 142 which is positioned adjacent to a

working surface area 160 of the carding cylinder. The heel 142 of the carding flat is separated from the working surface area by a distance 144. The carding surface of the carding flat in cooperation with the surface of the carding cylinder defines a throat 147 by which material enters the carding working area. The size of the throat depends on the angle 148 subtended between the surface of the carding flat and the tangent to the carding cylinder at the carding working surface area. The inclination of the carding flat with respect to the carding cylinder corresponds to the inclination angle 148.

With reference to figure 3, there is shown a schematic end view down the throat 147 of the working region 160 of a conventional carding engine. Disposed at either end of the carding engine is a respective flexible bend 150 upon which carriage members 152 travel by means of bearings 154. The carding flat 140 is supported on the carriage means 152. The separation 144 of the carding flat heel from the working surface area is determined by shim members 156 located between the carriage means and support parts 158 of the carding flat. The assembly of carding flat, shim and carriage members is assembled by means of a screw such that the angle of inclination of the carding flat is fixed and can only be adjusted by disassembling the assembly and re-machining the flat so as to change its geometry.

With reference to figure 4, there is shown a perspective view of a part of an embodiment of an adjustable carding flat assembly according to the invention, designated generally by reference numeral 400. The assembly is for use in a carding engine including a carding cylinder 160, a first guide means 150 and a second guide means 450. The assembly includes a first of a pair of carriage means 410. The carriage means has a pivot formation 412 in the form of

a hollow extending through a top part of the carriage. The top part of the carriage also has a recessed portion 440 which can accept part 433 of an adjustment member. The carriage 410 has a front portion 414 comprising first and second members 415, 416 extending downwardly from the top part of the carriage and defining a gap 417 therebetween. An axle 418 extends between members 415 and 416 and a roller means in the form of a wheel 419 is attached to a distal end thereof. In use, the wheel runs on the first guide means 150 which typically is in the form of a flexible bend. A slider may be provided on the carriage, instead of axle 418 and roller 419, so as to engage the guide means 150 in use.

A rear part of the carriage 420 has an aperture therein 421 providing a housing, for locating a bearing, by means of which similar carriages may be connected in a chain as will be described later.

The assembly also includes a carding flat 430 having a pivot member 431 and an adjustment member 432 attached at one end thereof. The pivot member 431 engages the pivot formation 412 of the carriage to pivotally support the carding flat 430. The adjustment member 432 comprises an extended member 433 having a roller 434 attached at a distal end thereof. In use the roller 434 engages the second guide means 450 as will be described in greater detail later. The adjustable carding flat assembly has mirror symmetry about its middle and includes further carriage means, pivot means and adjustment means on the opposite side to those shown in figure 4 and as illustrated schematically in figure 6. The adjustment member may include a slider instead of roller 434.

With reference to Figures 5 (a),(b),(c) & (d) and further reference to Figure 4, the pivot means has a longitudinally

axis 436 and the axle 418 has a longitudinally axis 438. Figure 5(c)&(d) are sectional views along lines AA' and BB' respectively. The position of the pivot formation 412 on the carriage is preferably chosen such that the pivot axis 436 and axle axis 438 are substantially parallel and substantially vertically aligned, i.e. the pivot axis and axle axis are substantially vertically in line. As illustrated in Figure 7, the separation 144 of the heel 142 of the carding flat 430 above the working surface area 160 of the carding cylinder 120 is substantially fixed. However, the angle of inclination 148 can be controlled by pivoting the carding flat 430 about pivot axis 436 by moving adjustment member 432. The position of adjustment member 432 is controlled by the relative height of the second guide means 450 with respect to a fixed point of the carding engine.

Preferably a number of adjustable carding flat assemblies are connected together to form a flexible chain as illustrated in Figure 6. Figure 6 shows a schematic plan view of a flexible chain of carding flat assemblies (the carding flats of the first and third members of the chain have been omitted for the sake of clarity). A first of a pair of carriages of a first assembly is connected to a first of a pair of carriages of a second assembly by means of the rear part of a carriage 420 engaging the gap 417 of the next carriage. Axle member 418 extends through the front portion of a carriage, passes through aperture 421 of the rear part of the previous carriage so as to mate the carriages in a flexible manner. Bearings may be included around the axle and are not shown in the Figures. A number of carding flat assemblies are joined together in this way to provide a continuous loop of adjustable carding flat assemblies.

Use of the carding flat assembly in a carding engine will now be described with reference to Figure 8. A carding engine including a carding cylinder 120 a first guide means 150 in the form of flexible bends disposed at opposite ends of the carding cylinder and second guide means 450 also in the form of flexible bends disposed at opposite ends of the carding cylinder supports a continuous chain of adjustable carding flat assemblies, only four of which are shown. The carriages disposed at either end of the carding flats form the link members of two parallel chains and the axles connecting the carriages provide the pin members for the chain. Rollers 419 on the ends of the axles provide means to engage the first and second parts of the flexible bends 150 to support the flats 430 and guide them as they travel around the flexible bends. The second guide means 450 is also in the form of a pair of flexible bends disposed at opposite ends of the carding cylinder. Roller means 434 on distal ends of the adjustment means of the carding flats engage the adjustable bends 450.

The position of the second guide means 450 can be altered with respect to a fixed point on the carding engine by the provision of position adjustment means 460. When the second guide means is raised relative to the central axis of the carding cylinder the inclination angle 148 will be increased. When the second guide means 450 is lowered with respect to the central axis of the carding cylinder the angle of inclination will decrease. By varying the relative position of the second guide means with respect to a fixed point of the carding engine the angle of inclination of all the carding flats in the continuos chain can be controlled altogether. The inclination angle of the carding flats as they traverse they working area can be caused to change by providing a second guide means the position of which varies relative to the surface of the carding cylinder, e.g. by not

being parallel to the plane of the cylinder working surface. In this way the inclination angle can alter throughout the carding working area thereby changing the carding quality.

There is no need to adjust each carding flat individually, a single adjustment of the position of the carding guide means with respect to the carding engine is all that is required to set the angle of inclination of all the carding flats in the chain.

It will be appreciated that as the pivot axis 436 of the carding flat is substantially vertically aligned with the heel of the carding flat, adjustment of the inclination angle 148 will not substantially alter the separation 144 between the carding flat heel and the working surface area of the carding cylinder. This is preferred in order to maintain the separation of the heel of the carding flat from the carding cylinder.

The first and second flexible bends of the second guide means 450 may be a continuous guide way or may comprise separate sections of guide way. The second guide means may be substantially parallel to the surface of the carding cylinder throughout the working area of the carding cylinder or alternatively its relative position may vary around the working surface of the carding cylinder as to change the inclination angle of the carding flats as they traverse the working surface area of the carding cylinder to alter the quality of carding obtained.

The position adjustment means of the flexible bends 450 may be centrally located such that when it is actuated the flexible bends move outwardly or inwardly in a radial direction so that the entirety of the flexible bend changes its position. The position adjustment means may include a

set of support members 465 extending from a central support and bearing the flexible bends 450 such that the radial supports 465 extend or contract in response to operation of the position control means 460. Other similar position control devices are also envisaged, e.g hydraulically or pneumatically operated. Alternative ways of adjusting the position of the flexible bends 450 relative to a fixed point of the carding engine are considered to be within the knowledge of a man skilled in the art.

It will be appreciated that all of the carding flat assemblies in a chain may be angle adjustable or only a selected few may be. Further, in order to minimise any change in the separation 144 between the heel of the flat and the carding cylinder it will be appreciated that the bottom edge of the heel 142 should be co-linear with the pivot axis 436 and a configuration of carding flat 430, pivot member 431 and adjustment member 432 that could provide this is illustrated schematically in Figure 9. Although the carding flat assembly has been described utilising rollers, it will be appreciated that this feature is only preferred and that the carding flat assembly may slide on the guide means rather than travelling on rollers or wheels.

Figures 10 and 11 show side and plan views of an alternative carding flat assembly according to the invention. The adjustable angle carding flat assembly includes a carding flat 140. The flat is supported by a roller 500 which includes a wheel 510 with bearings on an extended member 520 which provides a support means which runs on a first guide means 150, in the form of a flexible bend. The support means, carding flat and position of the guide means relative to the working surface of the carding cylinder determine the separation setting of the heel of the flat from the carding

cylinder. The assembly also includes a further roller 550 including a wheel 552 with bearings on an extended member 554 which provides an adjustment member. The adjustment member engages a second position adjustable flexible bend 450 which provides a second guide means. By altering the position of the second guide means, the carding flat will tilt changing its angle of inclination with respect to the working surface are of the carding cylinder. The second guide means can be used to control the carding quality of the carding engine by altering the inclination of the carding flat.

Carding flat assemblies are joined together by a link member 560 to form a flexible chain. The link member connects between the support means of a first assembly and the adjustment member of a second assembly. The link member pivots about the adjustment member and has a hook formation which pivotally engages around the support means of the adjacent assembly so as to connect them while allowing sufficient flexibility in the chain of assemblies for the changes of inclination to be accommodated. The rollers can be spaced in a staggered fashion from the carding flat thereby allowing them to overlap.

It has been found that the quality of carding of the engine, i.e. its carding effect on carded material, can be changed merely by altering the inclination between the carding flat and the working area 160 of the carding cylinder. The changes in carding quality have been found to be comparable to those provided by conventional methods of changing carding quality, such as increases card flat lengths and providing a mix of stationary and moving carding flats and also changing the ration of stationary to moving carding flats. However, the present invention allows a single carding engine configured with pivotable flats to be able to

provide changes in carding quality when desired without having to re-engineer the engine, e.g. by fitting longer flats or providing stationary and moving flats. It will be appreciated that there are improvements in efficiency, control, costs and ease of use of the current method compared to the previous ones.

Claims:

1. A carding engine including a carding cylinder having a working surface area and at least one movable carding flat supported in a carding flat assembly adjacent the working surface area, in which the inclination of the carding flat relative to the carding cylinder is controllable to change the carding quality of the carding engine.

2. An adjustable carding flat assembly for use with a carding engine including a carding cylinder, a first guide means for guiding the movement of the flat assembly relative to the cylindrical working surface of the carding cylinder and a second guide means, the assembly including a movable flat, a support means and an adjustment member, in which the support means runs on the first guide means and the adjustment means engages the second guide means to control the inclination of the carding flat with respect to the carding cylinder.

3. An adjustable carding flat assembly as claimed in claim 2, in which the carding flat is tiltable.

4. An adjustable carding flat assembly as claimed in claim 2, in which the carding flat is pivotable.

5. An adjustable carding flat assembly as claimed in claim 2, in which the support means includes a pair of carriages each having a pivot formation; and the movable flat has pivot members each engaging a respective pivot formation of the pair of carriages, in which the pair of carriages are arranged to be guided by the first guide means.

6. An assembly as claimed in claim 5, in which the pivot members are positioned on the carding flat to be co-linear

with the heel of the carding flat such that the separation of the heel of the carding flat from a working surface of the carding cylinder remains substantially constant when the inclination of the carding flat is altered.

7. A carding engine including:

a carding cylinder;

a first guide means having first and second parts disposed at opposite ends of the carding cylinder;

a second guide means; and

a movable flat assembly as claimed in claim 2, in which a first part of the support means is arranged to travel on the first part of the first guide and a second part of the support means is arranged to travel on the second part of the first guide means and the adjustment means is engageable with the second guide means to control the inclination of the carding flat with respect to a cylindrical working surface area of the carding cylinder.

8. A carding engine as claimed in claim 7, in which the second guide means includes position adjustment means which act to alter the inclination of the carding flat.

9. A carding engine as claimed in claim 8, in which the position adjustment means changes the position of the second guide means radially.

10. A carding engine as claimed in any of claims 7 to 9, and having a plurality of adjustable carding flat assemblies connected together to form a flexible chain of assemblies.

11. A carding engine as claimed in claim 7, in which the first and second parts of the support means are a pair of carriages and the carriages of a first pair are each connected to a respective carriage of the next assembly in

the flexible chain of assemblies by an axle passing through a rear part of the carriages of the first pair and a front part of the carriages of the next assembly.

12. A carding engine as claimed in claim 11, in which the front part of each carriage has two formations defining a gap between them and the rear part of each carriage has a single formation which engages the gap of the next carriage in the chain.

13. A carding engine as claimed in claim 12, in which a longitudinal axis of the pivot formation of each carriage is parallel to and positioned substantially vertically above the longitudinal axis of the axle connecting each carriage to the next carriage.

14. A carding engine as claimed in any of claims 11 to 13, in which each axle has a roller on an end and the rollers of the carriages run on the first guide means.

15. A carding engine as claimed in any of claims 2 to 14, in which the adjustment means includes a first extended member attached to the carding flat and having a first roller on a distal end which runs on the second guide means.

16. A carding engine as claimed in claim 15, in which the second guide means has a first and a second part disposed at opposite ends of the carding cylinder, the first roller running on the first part of the second guide means, and the adjustment means includes a second extended member attached to the carding flat and extending in a direction opposite to the direction of the first extended member and having a roller on a distal end which runs on the second part of the second guide means.

17. A carding engine as claimed in any of claims 2 to 16, in which the second guide means includes a flexible bend.

18. A carding engine as claimed in claim 17, in which the position of parts of the flexible bend can be adjusted independently.

19. A carding engine as claimed in claim 17 or claim 18, in which the flexible bend comprises a number of sections.

20. A method of operating a carding engine including a carding cylinder and a carding flat assembly having a movable flat adjacent a working area of the carding cylinder, in which the method includes altering the inclination of the carding flat relative to the working area so as to change the quality of carding.

21. A method of operating a carding engine as claimed in claim 20, the carding engine including a guide means and the method including altering the position of the guide means relative to a fixed point of the carding engine so as to alter the inclination of the movable flat with respect to a working surface area of the carding cylinder so as to control the quality of carding.

22. A method as claimed in claim 20 or 21 in which the carding flat is tiltable.

23. A method as claimed in claim 20 or 21 in which the carding flat is pivotable.

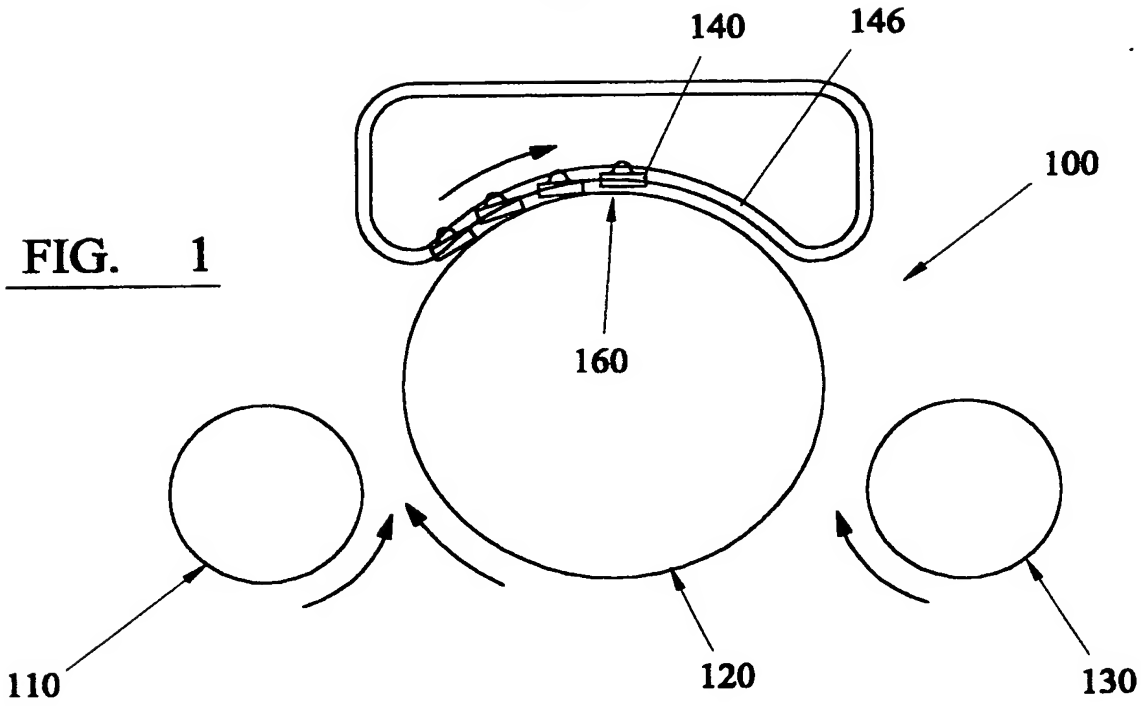

FIG. 1

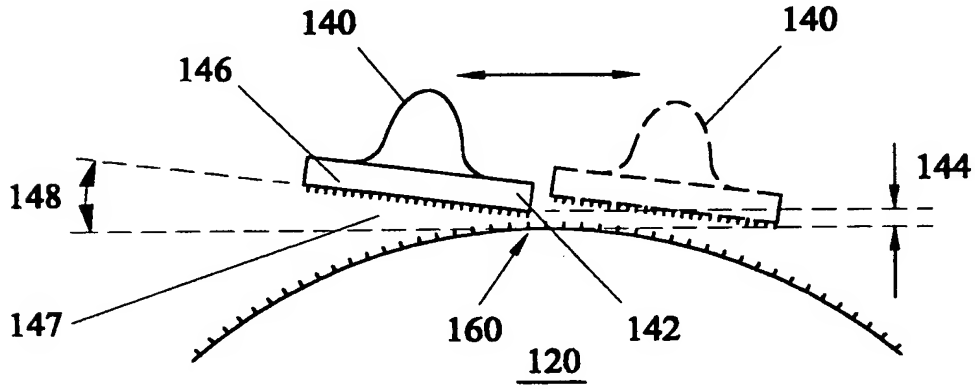

FIG. 2

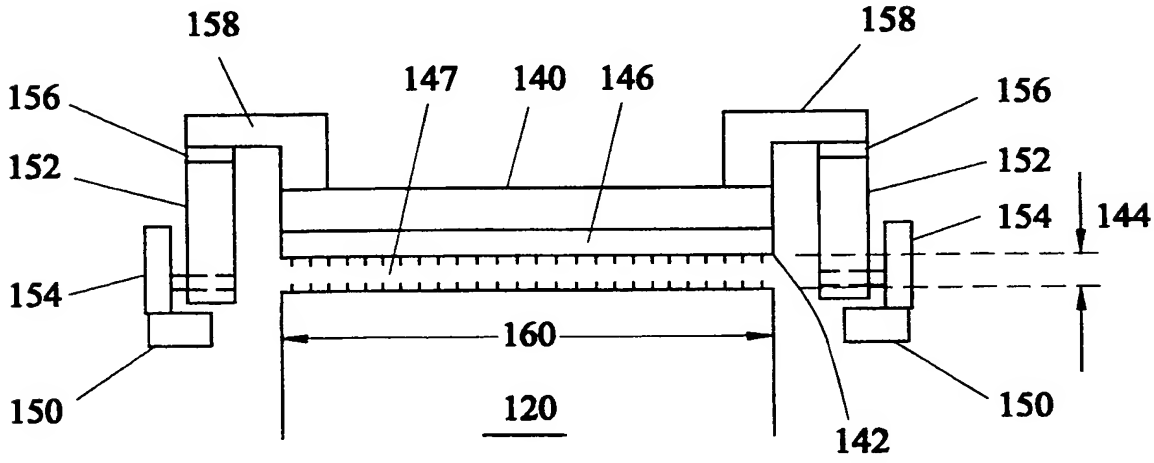

FIG. 3

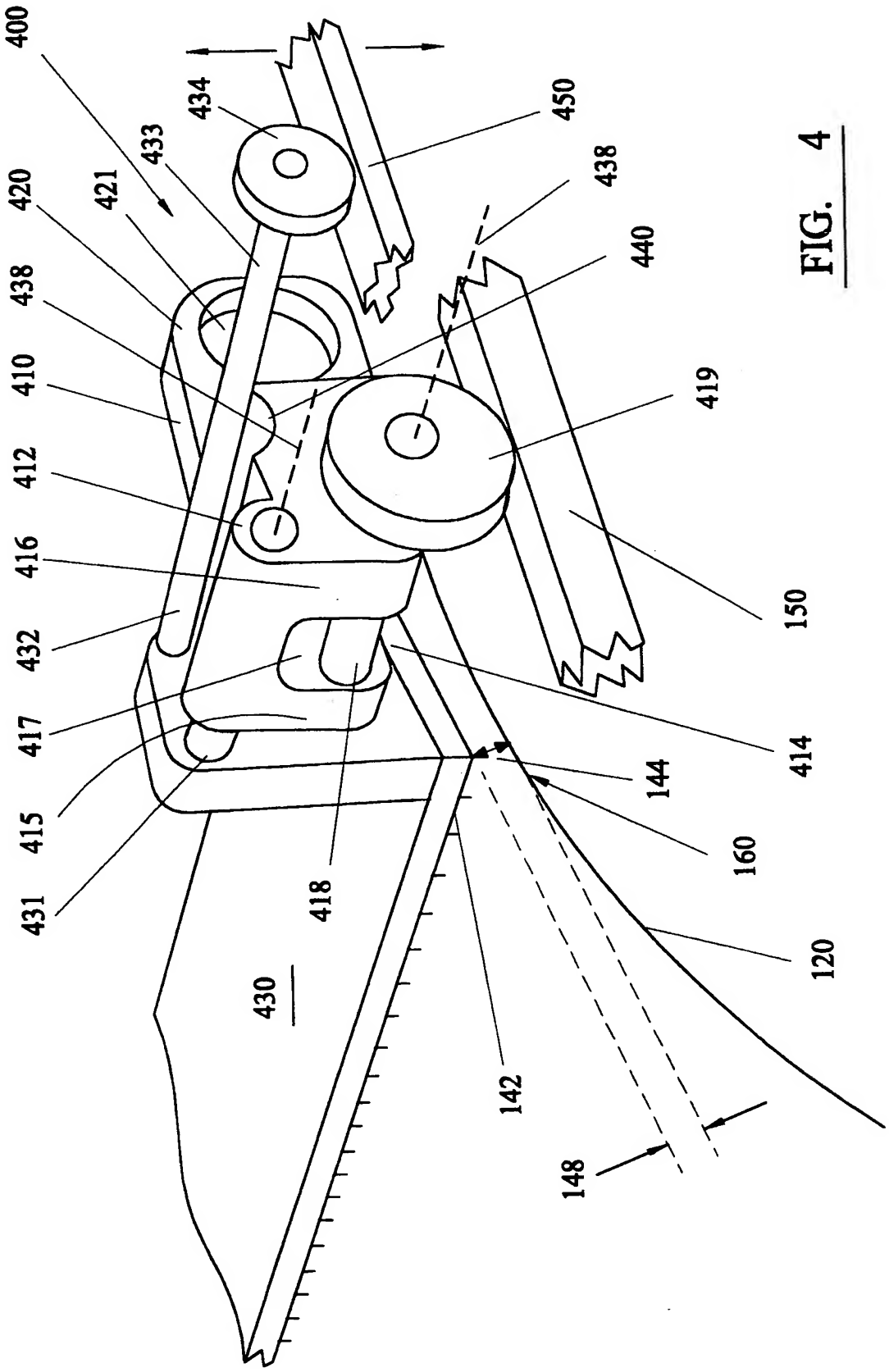
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FIG. 4

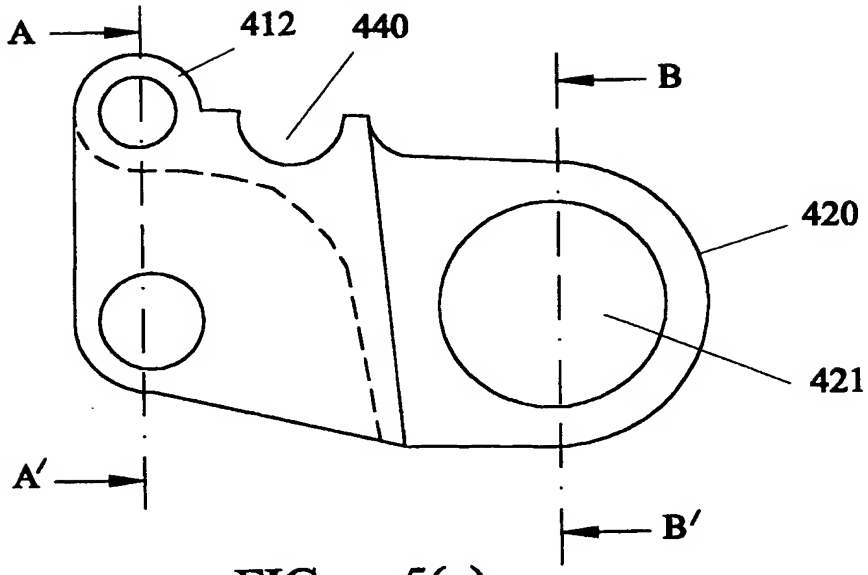


FIG. 5(a)

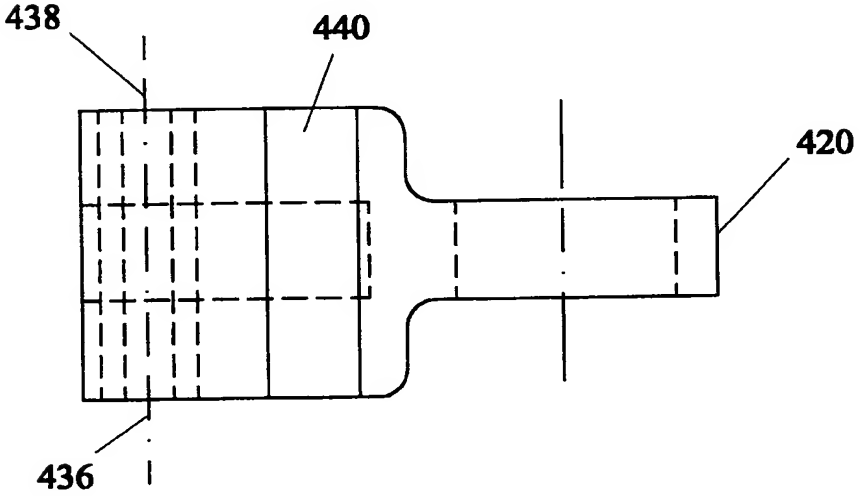
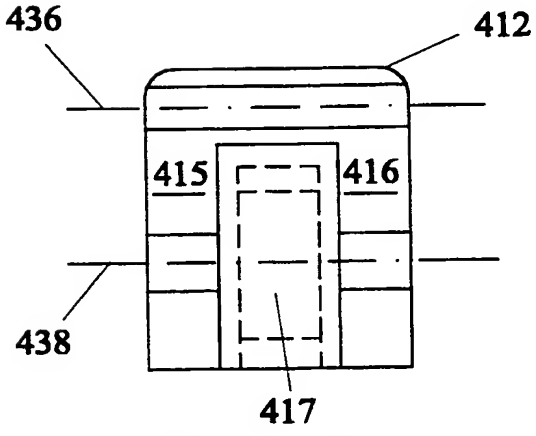


FIG. 5(a)



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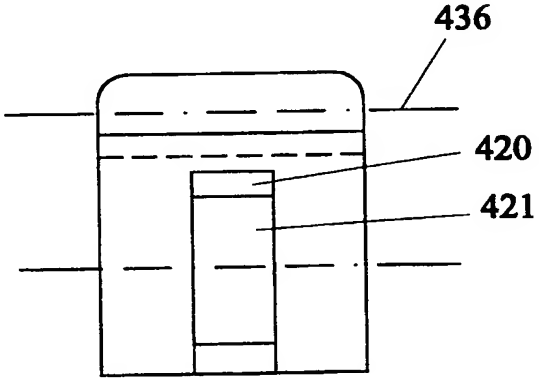

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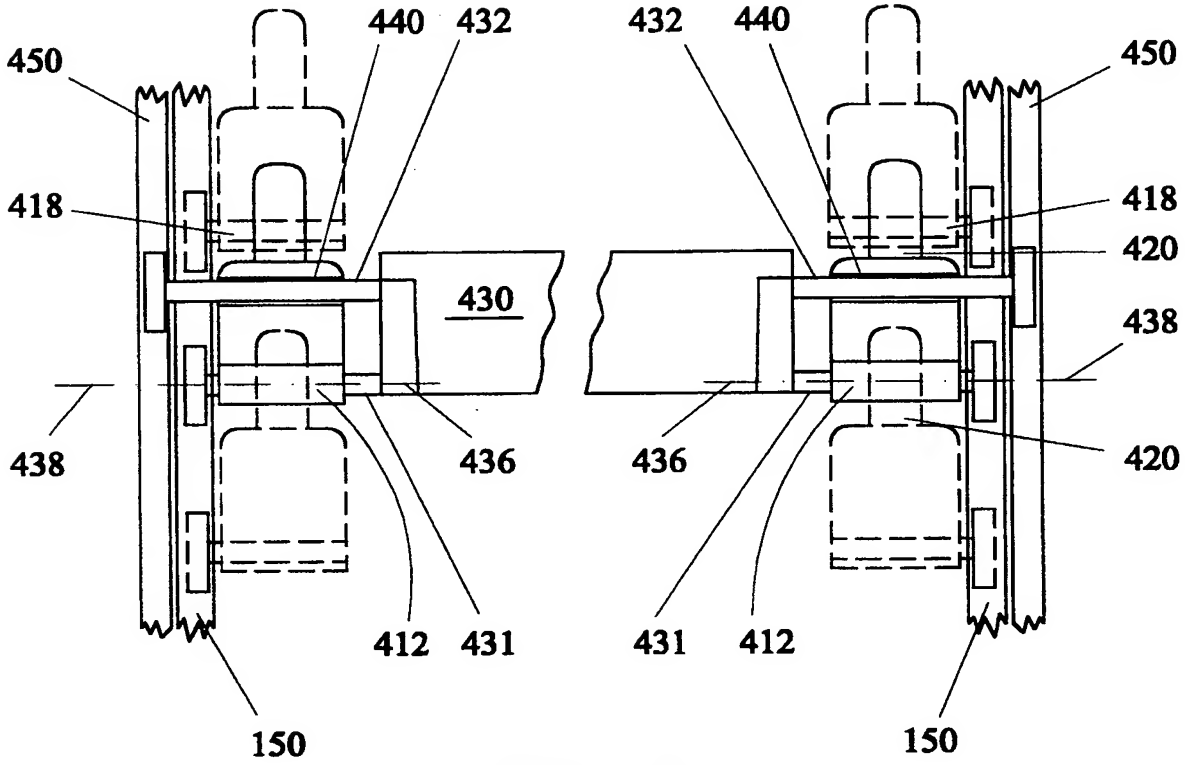
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FIG. 6

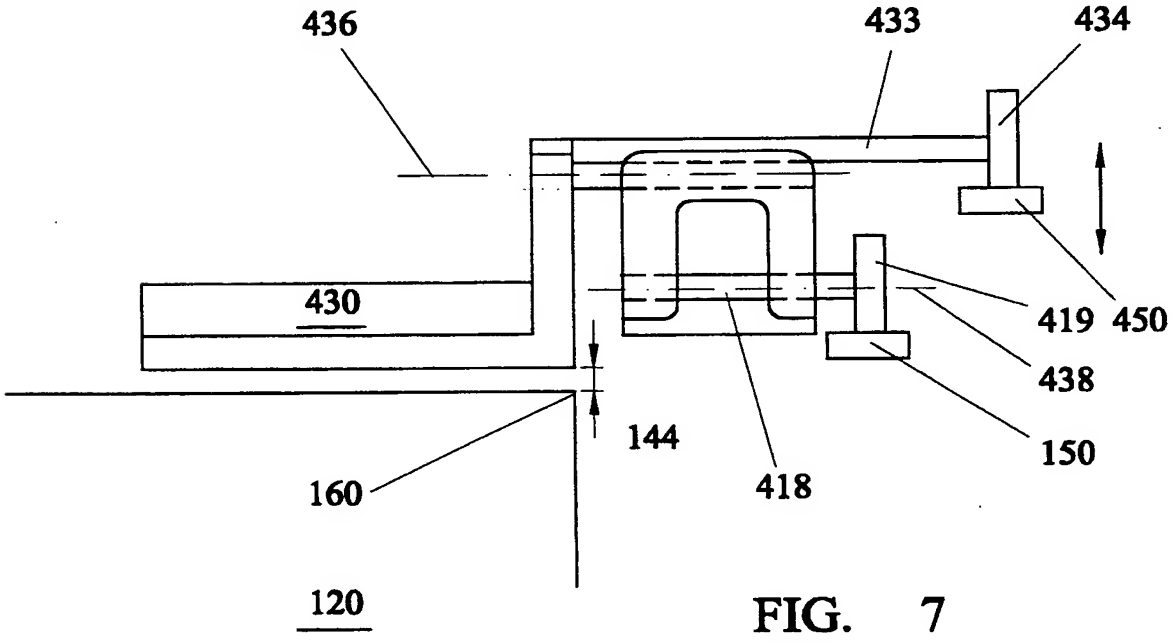
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FIG. 7

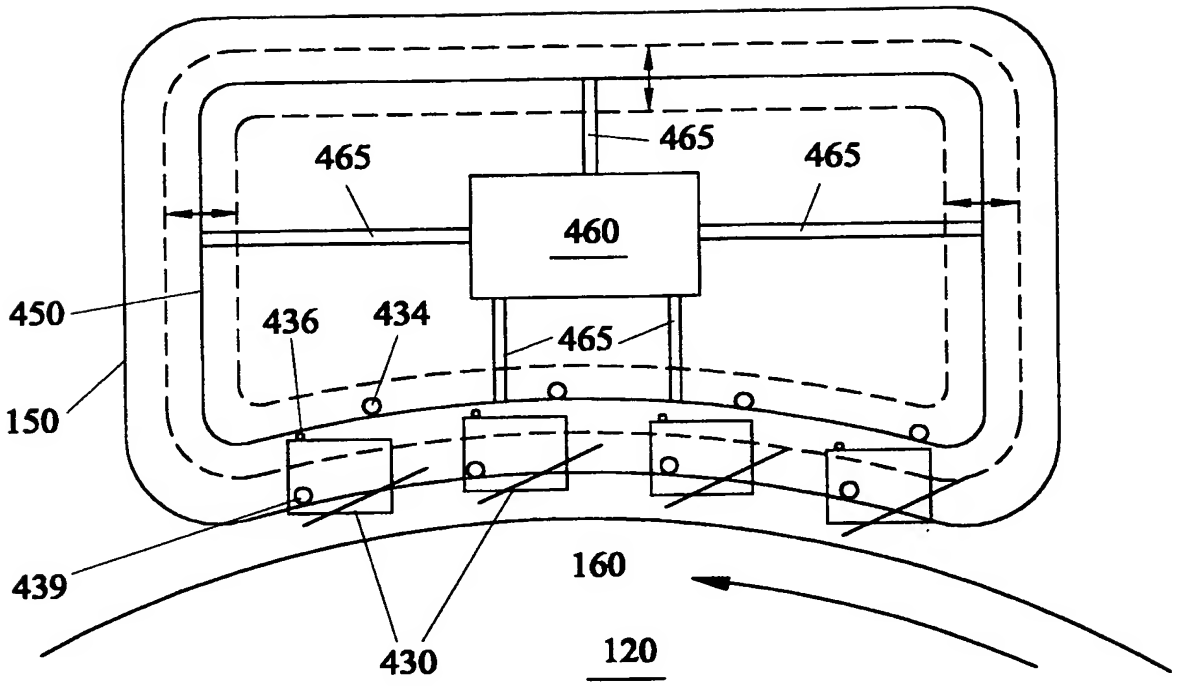
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FIG. 8

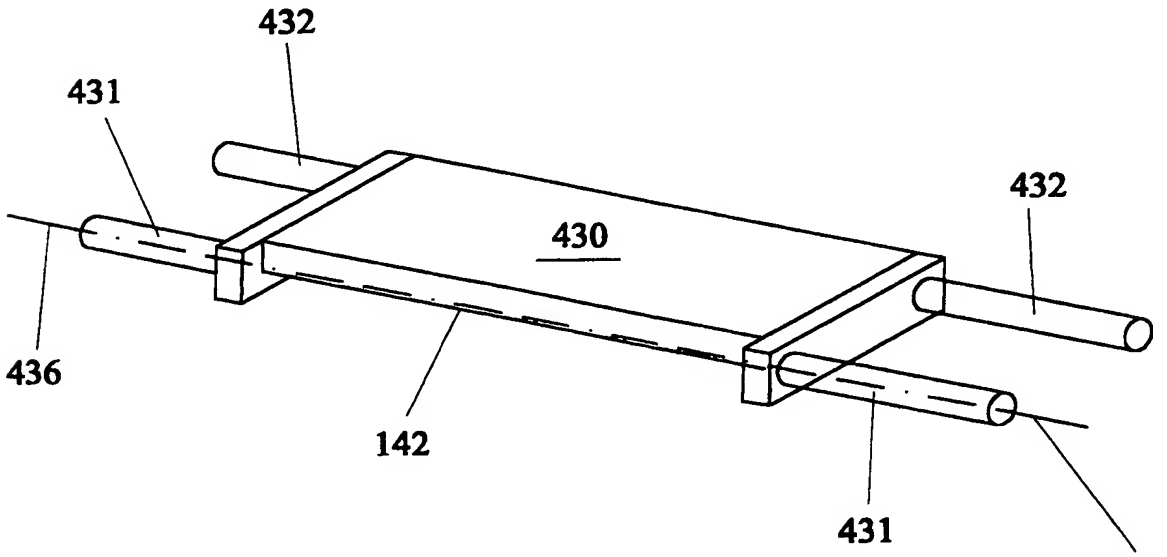
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FIG. 9

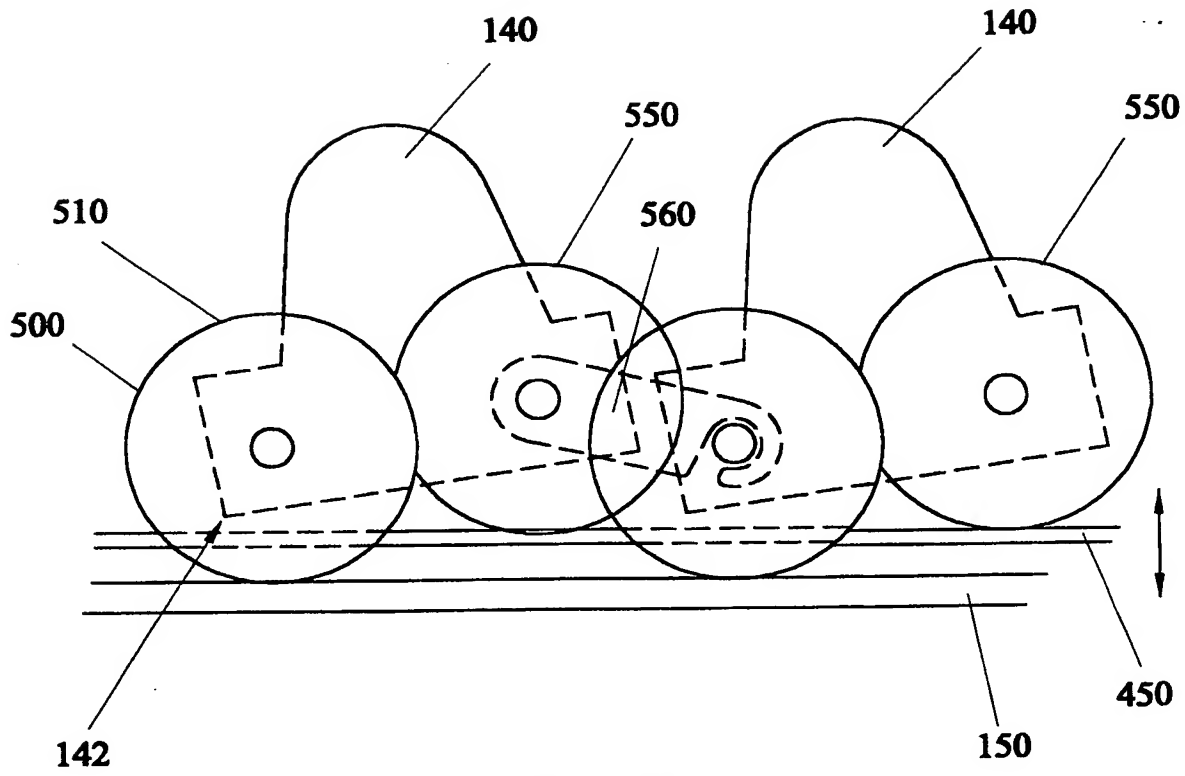
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FIG. 10

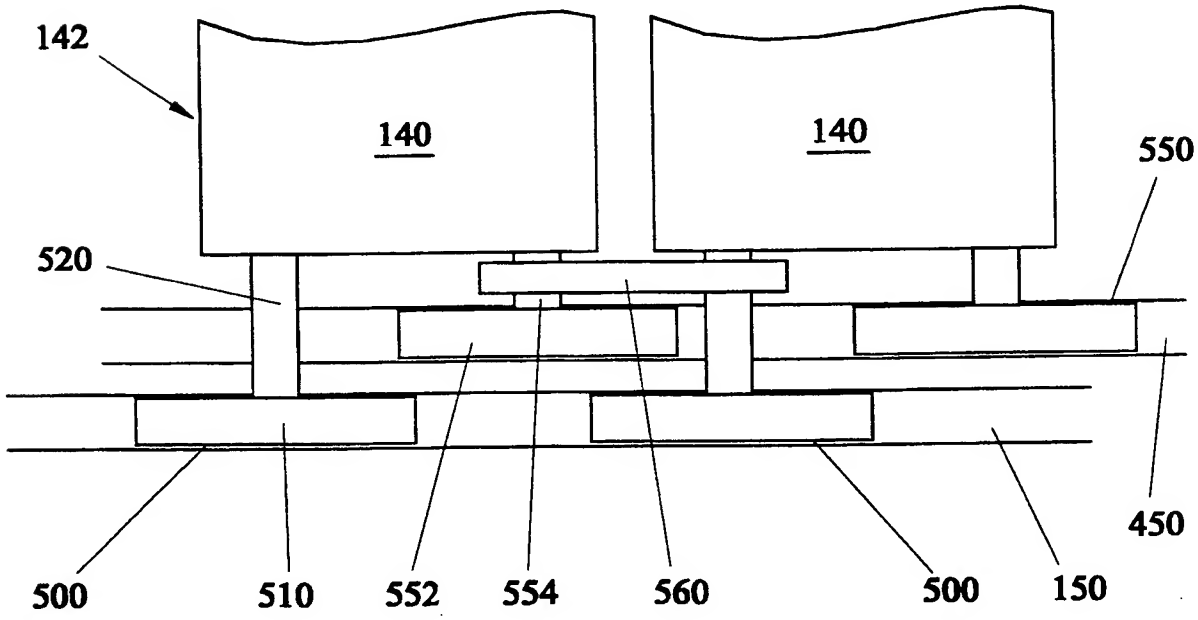
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FIG. 11

INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/GB 99/02213

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 D01G15/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 D01G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DE 94 14 450 U (KÄNDLER MASCHINENBAU GMBH) 10 November 1994 (1994-11-10) page 6, paragraph 2 -page 8, paragraph 4; claims 1,6-9; figures 2-6 page 10, paragraph 7 -page 16, paragraph 6	1,2,7,20
A	---	10,23
Y	WO 95 33875 A (CARDING SPECIALISTS (CANADA) LTD) 14 December 1995 (1995-12-14) page 3, paragraph 3 -page 4, paragraph 4 page 7, paragraph 2 -page 9, paragraph 3 page 10, paragraph 1 - paragraph 3; claims 1,2; figures 4-8	1,2,7,20
A	---	17,21
	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search	Date of mailing of the international search report
9 November 1999	16/11/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Munzer, E

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INTERNATIONAL SEARCH REPORT

Inte ional Application No
PCT/GB 99/02213

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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Inte ional Application No
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